

**The rice *Osmyb4* gene enhances tolerance to frost and improves germination under unfavourable conditions in transgenic barley plants**

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#### Abbreviations

GP: Golden Promise

RWC: relative water content

CSVT: complex stressing vigour test

AMY: alpha-amylase

ASAT: aspartate aminotransferase

LDH: lactate dehydrogenase

#### Abstract

The *Osmyb4* rice gene, coding for a transcription factor, proved to be efficient against different abiotic stresses as a trans(cis)gene in several plant species, although the effectiveness

was dependent on the host genomic background. Eight barley transgenic lines carrying the rice *Osmyb4* gene under the control of the Arabidopsis cold inducible promoter *cor15a* were produced to test the efficiency of this gene in barley. After a preliminary test, the best performing lines were subjected to freezing at  $-11^{\circ}\text{C}$  and  $-12^{\circ}\text{C}$ . Frost tolerance was assessed measured the  $F_v/F_m$  parameter widely used to indicate the maximum quantum yield of photosystem II photochemistry in the dark adapted state. Three transgenic lines showed significantly increased tolerance. These selected lines were further studied under a complex stress applying cold and hypoxia at germinating stage. In these conditions the three selected transgenic lines outperformed the wild type barley in terms of germination vigour. The transgenic plants also showed a significant modification of their metabolism under cold/hypoxia conditions as demonstrated through the assessment of the activity of key enzymes involved in anoxic stress response. None of the transgenic lines showed dwarfism, just a slight retarded growth. These results provide evidence that the cold dependent expression of *Osmyb4* can efficiently improved frost tolerance and germination vigour at low temperature without deleterious effect on plant growth.